



EFFECT OF COMPUTER ASSISTED INSTRUCTION ON STUDENTS' ACADEMIC ACHIEVEMENT AND RETENTION IN NUTRITION CONTENT OF SECONDARY SCHOOL BIOLOGY IN ONITSHA EDUCATION ZONE

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ABSTRACT

This study was conducted to determine the effect of computer assisted instruction on student academic achievement and retention in nutrition content of secondary school biology in Onitsha Education Zone of Anambra State. The study adopted a quasi-experimental design using pretest and posttest. The population for the study consisted of 5,626 SS1 Biology students in all the 32 secondary schools in Onitsha education zone of Anambra State with a sample size of 252 biology students (116 male and 136 female) undertaken using multi-stage sampling technique. Four research questions and four corresponding null hypotheses guided the study. The instrument for data collection was a Biology Achievement Test developed from nutrition in living organisms with multiple choice questions consisting of 50 items with options lettered A-D. The instrument was validated by three experts while the reliability of the instrument was determined using Kuder Richardson's formula 20 technique. The internal consistency reliability index was 0.74. The data collected were analyzed using mean scores. The hypotheses formulated for the study were tested at 0.05 level of significance using Analysis of Covariance. Findings of the study revealed that the students taught Biology using Computer assisted instruction, CAI achieved higher than students taught using lecture method. Also, there is a significant difference between the mean academic achievement scores of students taught nutrition in living organisms using CAI and that of those taught using lecture method. It was recommended that the government should assist Biology teachers in the use of CAI for effective services delivery in secondary schools in Anambra State.

Keywords and Phrases: Computer assisted instruction, academic achievement, retention and Biology.

INTRODUCTION

Secondary school is an educational level that prepares students for the continuation of learning after primary school stage. The students are taught higher concepts other than the primary stage. Secondary education according to Federal Republic of Nigeria (FRN), (2013) is the education children receive after primary education and before the tertiary stage. Accordingly, secondary education in Nigeria is anchored on United Nations Educational, Scientific and Cultural Organization (UNESCO) objectives in conjunction



with the Federal Republic of Nigeria (FRN) (2013) in its National Policy on Education and thus, stating the objectives of education inter alia;

provide holders of the Basic Education Certification with the opportunity for education of a higher level, irrespective of sex, social status, religious or ethnic background; offer diversified curriculum to cater for the difference in talents, opportunities and future roles; provide trained manpower in applied science, technology and commerce at sub-professional grades and, provide entrepreneurial, technical and vocational job specific skills for self-reliance.

In the secondary school, students are taught various subjects including science subjects. Science may be seen as the systematic body of knowledge obtained by systematic methods and techniques involving scientific observations and experimentations. Godswill (2016) defined science as rationally structured knowledge about nature, which embraces systematic methods of positive attitudes for its acquisition, teaching, learning and application. Science seeks to explain the natural phenomenon using enquiry processes or activities. Some branches of science are: Biology, Physics, Chemistry, among others which can be broadly classified into natural and applied sciences (Aigbomian, 2012). Biology is one of the science subjects taught in senior secondary schools. FRN (2013) noted that biology is introduced to students at senior secondary school level as a preparatory for human development, where career abilities are groomed, potentials and talents discovered and energized. The author further stated that students are taught Biology in secondary schools to prepare them for senior secondary certificate examinations in Nigeria (FRN, 2013). Interestingly, it is a popular subject among students and its popular nature among other science subjects has made it unique choice for most students (Lawal, 2011). Biology is a natural science that deals with the living world: How the world is structured, how it functions and what these functions are, how the world develops, how living things came into existence, and how they interact with one another and with their environment (Umar, 2011). Biology is a very important science subject and a requirement for further studies of other science-based professional courses such as Medicine, Agriculture, Pharmacy, Biotechnology, Genetic Engineering, etc. Biology is the key to economic, intellectual, sociological, human resource development and wellbeing of any society. According to Ahmed (2008), it is a prerequisite subject for many fields of learning that contributes immensely to the technological growth of the nation. Chukwuneke and Nwachukwu (2005) also noted that it is of importance in many ways for both individual and societal development as seen in Biotechnology and Genetic Engineering. Thus, biology is a component of Science Education.

The quality and quantity of science education received by secondary school students are geared towards developing future scientists, technologists, engineers, and related professionals (Kareem, 2013). It is however disheartening that the quality of teaching Biology is declining and it seems that the objective of this subject has not been



realized as poor performances of students in the subject has been recorded over time. Studies have shown that secondary school students are exhibiting low achievement in biology (Esiobu, 2005; Ahmed, 2008 and WAEC, 2014). Okebukola (2005) lamented on the decline in the standard of science teaching in Nigeria. The report of West African Examination Council (WAEC) on the Senior Secondary School Certificate Examination (SSCE) (2011) about Nigerian students enrolment and performance by subject, grade, and sex revealed low academic achievement in biology and other science subjects and the general persistent poor students' achievement in Biology (WAEC, 2016). Ahmed (2008) noted that in spite of the importance and popularity of biology among Nigerian students, performance at senior secondary school level has been poor. The author stressed that the issue remains that in most secondary schools in Nigeria, there is high rate of failure in the subject.

Unfortunately, students' achievement in biology at the end of the secondary school has not improved in the last decade (Umoinyang, 2009). Abimbola (2013) also stated that the performance level for individual science subjects especially in biology did not show any significant rise for a twenty-five year period between 1991 and 2016, except occasionally for chemistry and physics.

A factor contributing to poor performance of students in biology has been identified to be poor teaching methods adopted by teachers at senior secondary school level in Nigeria (Kareem, 2013; Ahmed & Abimbola, 2011 and Umar, 2011). Nwagbo (2011) also identified a number of factors obstructing students' achievement in the science subjects and among these factors is the use of inappropriate, non-effective teaching methodology. Folorunso (2014) in another study linked poor achievement trend in biology particularly to the lack of instructional resources in schools due to poor funding of schools. Poor funding of schools has hindered the principals from providing the teachers with adequate instructional resources, which assist in achieving the stated behavioural objectives and help students to retain knowledge for longer periods (Ajaja, 2013).

Accordingly, Nwosu (2014) submitted that most science teachers do not possess the prerequisite knowledge needed for activity-based learning and as a result, the most prevalent method of teaching has been the 'talk and chalk' (lecture) method. Ajaja (2013) identified the method adopted for teaching and learning science as one of the factors contributing to this low achievement in science and hence, the need for a search for alternative instructional strategies that could stimulate students' interest and enhance their achievement. Ahmed and Abimbola (2011) noted that the conventional (lecture) teaching method is classroom-based and consists of lectures and direct instructions conducted by the teacher. The authors believed that the teacher-centered method emphasizes learning through the teacher's guidance at all times. The students listen to lectures and learn from them. The teacher often talks to the students instead of encouraging them to interact, ask questions, or make them understand the lesson thoroughly. Umar (2011) indicated that the persistent use of conventional (lecture) lecture teaching method like drills, dictation and explanation makes students passive rather than active learners, and hence it does not



promote insightful learning and long-term achievement and retention of some abstract concepts in Biology.

On the other hand, Akubilo (2005) noted that teaching is no longer restricted to teachers as encyclopedia of knowledge irrespective of the fact that teachers play important role in any curriculum implementation. The use of various innovative teaching strategies like Computer Aided Instruction (CAI) is borne out of the fact that there are different topics to be taught and skills intended to be developed. In this case, many innovative strategies have been developed by educators with a view to involving learners more in the teaching learning process. There is therefore the need to determine the effect of computer assisted instruction (CAI) strategy on student's academic achievement and retention in Biology.

Computer assisted instruction (CAI) may be seen in this context as the use of computer and its technologies including internet in the delivery of lessons. Milken Exchange on Education Technology (2015) defined CAI as computer-based tools used by people to work for the information and communication processing needs of an organization. It encompasses the computer hardware and software, the network and several other devices (video, audio, photography camera, etc) that convert information (text), images, sound, motion and so on into common digital form. Onyebuenyi, Mbah, and Odeluga (2017) perceived CAI as sets of technological facilities systematically and scientifically harnessed for transmission of information from one point to another. Abolade and Yusuf (2005) posit that information and communication technologies are essential tools in any education system with the possibilities of being used to meet the learning needs of individual learners, support equality of education opportunities, offer high quality learning materials, increase self-efficacy and independence of learning among students, and enhance teachers' professional development.

However, CAI can be an effective medium through which students can acquire relevant knowledge including Biology. In this view, Sedega, Mishiwo, Fletcher, Kofi and Awudetsey (2017) indicated that computer assisted instructional approach has much gain in terms of students' achievement than the traditional approach in the teaching and learning. Danjuma (2015) was of the opinion that the use of CAI can improve students' academic achievement and retention. Cotton (2011) explained that the use of CAI in teaching can improve students' retention in any course of learning. On this background, it could be pertinent to state that effective adoption of the afore-discussed strategies may enhance students' academic achievement and retention and therefore, there is need for them to be utilized effectively in teaching biology in secondary schools to improve students' achievement and retention in the subject.

Academic achievement may be seen as the measure of the product of effective teaching activity. In this context it can be seen as the measure of the degree of acquired knowledge of students especially in biology. Ncharam (2010) defined academic achievement as the actualization of the education standard and appropriate goals as the major objective of school in the society. The author maintained that the yardstick for measuring one's level of academic achievement should be through test and observation



and further explained that academic achievement has three dimensions such as high, average and low academic achievement. Academic achievement helps in proper evaluation of students and identification of their strengths and weaknesses. Academic achievement is thus very significant in this study as it serves a measure of assessment of performance of students in biology.

With these views, it is pertinent to state that academic achievement of students especially in biology is the measure of the degree to which the students have acquired or attained the set objectives of biology as a science subject which could be attributed to their level of retention. When students easily remember what they learnt in classrooms, their possibilities of performing well in that topic will be obvious. On this note, Gale (2012) stated that students' retention is correlated with students' academic achievement.

Retention on the other hand, is the condition of keeping or being able to remember something after a long-time. Azevedo (2013) explained that a person may be able to memorize facts in the short-term, but does not retain them. In this context, retention is a very important because it concerns itself with the ability of Biology students to keep or store and remember ideas or concepts over time. Therefore, retention is the ability to remember information or ideas in the future. However, academic achievement and retention of students may vary depending on gender. Dania (2014) investigated gender differences in academic achievement and found different result.

Gender can be defined as the difference between women and men based on the biological division between male and female. Gender is defined as the range of physical, biological, mental and behavioural characteristics pertaining to, and differentiating between, masculinity and femininity (Amosun, 2011). Nwona and Akogun (2015) in a study that examined race, gender and students' achievement reported that gender has significant effect on students' academic achievement. In contrary, Eze (2013) revealed that gender has no significant effect on the students' academic achievement. Gender in this context qualifies the sex of the students (boys and girls) with various achievement and behaviour in school. Hence, gender is considered significant in this study as there may appear to be differences between the performances of male and female students. The outcome of the present study will reveal whether gender has any interaction effect on the treatment (CAI) on students' achievement and retention in nutrition content of secondary school Biology in Onitsha education zone of Anambra State.

Biology is very important for national development because it serves as a spring board for many science based professions and it also has application nearly in every field of life. The persistent poor achievement of biology students in examinations in Nigeria at the senior secondary school level particularly Onitsha education zone of Anambra State is a matter of serious concern to all stakeholders. Reports have shown poor performances of students in biology in both internal and external examinations whereas biology as a practical-oriented subject is expected to enhance better understanding of the learned concept and thus improve students' academic achievement, but the reverse has been the case in Onitsha education zone of Anambra State. By the researcher's observation, many



students have resorted to studying arts and its related subjects since most of the students offering biology perform poor in external examinations, thereby making them to re-sit biology examination severally while others are found roaming the streets as drop-out and invariably involving in socio-economic vices like robbery, smoking and drug addiction. This has been attributed to the teaching strategies, like teacher led discussion and dictation adopted by many teachers in the teaching of biology in secondary schools in Onitsha education zone of Anambra State which is seen to be unsatisfactory in imparting the desired knowledge into the students. Hence, there is need to ascertain the efficacy of innovative teaching strategies like the CAI which appears to have great potential in imparting knowledge effectively into students. On this background, the study therefore seeks to determine the effect of CAI on student academic achievement and retention in nutrition content of secondary school Biology in Onitsha education zone of Anambra State.

PURPOSE OF THE STUDY

The purpose of this study is to determine the effect of CAI on students' academic achievement and retention in nutrition content of secondary school Biology in Onitsha education zone of Anambra State. Specifically, the study intends to determine the;

1. mean achievement scores of SS I biology students taught nutrition in living organisms using CAI and those taught using conventional (lecture) method
2. mean retention scores of SS I biology students taught nutrition in living organisms using CAI and those taught using conventional (lecture) method

RESEARCH QUESTIONS

The following research questions guided the study:

1. What is the mean achievement scores of SS I biology students taught nutrition in living organisms using CAI and those taught using conventional (lecture) method
2. What is the mean retention scores of SS I biology students taught nutrition in living organisms using CAI and those taught using conventional (lecture) method

HYPOTHESES

The following null hypotheses formulated which were tested at 0.05 level of significance were formulated to guide the study:

- Ho₁:** There is no significant difference in the mean achievement scores of SS I Biology students taught nutrition in living organisms using CAI and those taught using lecture method
- Ho₂:** There is no significant difference in the mean retention scores of SS I biology students taught nutrition in living organisms using CAI and those taught using lecture method



METHOD

The design of the study was quasi-experimental design involving pretest, posttest/non-randomized control groups. The study was carried out in Onitsha Education Zone of Anambra State. The population for the study was 5626 SSI biology students, while the sample size of 252 (116 male and 136 female) biology students were drawn using multi-stage sampling technique. Where; purposive sampling technique was used to select all the 28 co-education schools from the 32 schools in Onitsha education zone. Out of the 28 co-education schools with CAI facilities, two co-education schools with at least, three intact classes were sampled purposively. From the two co-education schools, purposive sampling was also used to select one co-education school while simple random sampling technique (balloting) was used to sample 3 classes of 84 biology students from each of the classes. Next, balloting was used to assign each of the classes to either one of the two experimental groups or the control group. This constituted a sample of 252 biology students (116 males and 136 females) for the two experimental and one control groups. In this case, 37 male and 43 female (80) students was assigned to experimental group 1, 31 male and 39 female (70) assigned to experimental group 2 while 48 male and 54 female (102) students was assigned to control group respectively. The instrument for data collection was a 50-item Biology Achievement Test (BAT) drawn by the researcher from WAEC and NECO past questions with 2 marks allocation of 0 and 100% minimum and maximum scores. The instrument was face-validated by three experts while the reliability of the instrument was determined by administering the test to 20 SSI biology students in Community Secondary School, Isuanaocha in Awka education zone, Anambra State who were not part of the population but of similar characteristics. Kuder-Richardson Formula 21 was used to analyze the data and a reliability coefficient of 0.74 was obtained. Data collected were analyzed using mean scores to answer the research questions and Analysis of Covariance (ANCOVA) was used to test the null hypotheses at 0.05 level of significance. Results of the pre-test, post-test and delayed post-test were used for data analyses.

RESULTS

The results are presented in Table 1 to 4 in line with the research questions and null hypotheses that guided the study below.

RESEARCH QUESTION ONE

What are the mean achievement scores of SS I Biology students taught nutrition in living organisms using CAI and lecture method?



Table 1: Mean and standard deviation Achievement Scores of SS I biology Students Taught Nutrition in Living Organisms using CAI and Conventional (lecture) Method

GROUP STATISTICS	N	PRETEST		POSTTEST	
		Mean	SD	Mean	SD
<i>Experiment group I (CAI)</i>	80	30.48	5.85	66.05	8.06
<i>Control group (lecture) method)</i>	103	30.58	6.40	44.86	6.13

Table 1 shows that the pretest mean and standard deviation scores of students in experimental group I is 30.48 and 5.85 respectively, while that of those in control group is 30.58 and 6.40 respectively. The difference in their mean achievement is negligible. But after treatment (using CAI in teaching nutrition in living organisms), the experimental group I had mean achievement of 66.05 with corresponding standard deviation of 8.06. However, the control group had mean achievement score of 44.86 with standard deviation of 6.13. This implies that the students taught with CAI base method performed better in the achievement test than those taught with conventional (lecture) method.

HYPOTHESIS ONE

There is no significant difference in the mean achievement scores of SS I biology students taught nutrition in living organisms using CAI and conventional (lecture) method.

Table 2: Analysis of Covariance of the mean achievement scores of male and female of SS I biology students taught nutrition in living organisms using CAI and conventional (lecture) method

Source	Type II Sum of Squares	df	Mean Square	F	Sig.	Decision
<i>Corrected Model</i>	20245.459 ^a	3	6748.486	135.444	.000	
<i>Intercept</i>	550904.188	1	550904.188	11056.813	.000	
<i>GROUP</i>	19984.366	1	19984.366	401.092	.000	S
<i>GENDER</i>	1.188	1	1.188	.024	.877	NS
<i>GROUP * GENDER</i>	35.128	1	35.128	.705	.402	NS
<i>Error</i>	8918.650	179	49.825			
<i>Total</i>	565279.000	183				
<i>Corrected Total</i>	29164.109	182				

Key: S = Significant, NS = Not Significant



Table 2 shows that the F-value on mean achievement score of students taught nutrition in living organisms using CAI base strategy and conventional (lecture) method is 401.092 which is significant at 0.000 level of significant, which is less than 0.05 level of significant set for the study. Therefore, the null hypothesis is rejected; this means that there is a significant difference between the mean academic achievement scores of students taught nutrition in living organisms using CAI base strategy and that of those taught using conventional (lecture) method.

RESEARCH QUESTION TWO

What is the mean retention scores of SS I biology students taught nutrition in living organisms using CAI and conventional (lecture) method?

Table 5: Mean and standard deviation retention Scores of SS I biology students taught nutrition in living organisms using CAI and conventional (lecture) method

GROUP	N	Mean	SD
<i>Experiment group I (CAI)</i>	80	61.05	7.24
<i>Control group (Conventional (lecture) method)</i>	103	34.34	7.91

Table 5 shows that the retention mean scores of students in experimental group I is 61.05 and 7.24 respectively, while that of those in control group is 34.34 and 7.91 respectively. The difference between the two scores was large. This implies that the students taught with CAI base method retained better than those taught with conventional (lecture) method.

HYPOTHESIS TWO

There is no significant difference in the retention scores of SS I biology students taught nutrition in living organisms using CAI and conventional (lecture) method.

Table 6: Analysis of Covariance of the retention scores of male and female of SS I biology students taught nutrition in living organisms using CAI and conventional (lecture) method

Source	Type II Sum of Squares	df	Mean Square	F	Sig.	Decision
<i>Corrected Model</i>	32185.669 ^a	3	10728.556	183.714	.000	
<i>Intercept</i>	407226.478	1	407226.478	6973.268	.000	
<i>GROUP</i>	32105.588	1	32105.588	549.770	.000	S
<i>GENDER</i>	18.198	1	18.198	.312	.577	NS
<i>GROUP * GENDER</i>	35.988	1	35.988	.616	.433	NS
<i>Error</i>	10453.282	179	58.398			
<i>Total</i>	430143.000	183				
<i>Corrected Total</i>	42638.951	182				

Key: S = Significant, NS = Not Significant



Table 6 shows that the F-value on mean retention score of students taught nutrition in living organisms using CAI base strategy and conventional (lecture) method is 549.770 which is significant at 0.000 level of significant, which is less than 0.05 level of significant set for the study. Therefore, the null hypothesis is rejected; this means that there is a significant difference between the retention scores of students taught nutrition in living organisms using CAI base strategy and that of those taught using conventional (lecture) method.

DISCUSSION OF FINDINGS

With reference to mean achievement scores of SS I biology students taught nutrition in living organisms using CAI and conventional (lecture) method, the study revealed in Table 1 that students taught with CAI based method performed better in the achievement test than those taught with conventional (lecture) method. In this view, the difference in mean score between control and experimental groups show that the students taught with CAI perform better in the achievement test than those taught with conventional (lecture) method. Additionally, the hypothesis text of no significant difference showed that there is a significant difference between the mean academic achievement scores of students taught nutrition in living organisms using CAI based strategy and that of those taught using conventional (lecture) method. On this background, it becomes imperative to state that CAI is an innovative teaching method that enhances academic achievement and retention of students in sciences, especially biology. However, this finding is in agreement with the findings of Dania (2014) who was of the opinion that the use of CAI can improve students' academic achievement and retention. This was supported by Cotton (2011) explained that the use of CAI in teaching can improve students' retention in any course of learning.

With reference to the mean retention and standard deviation scores of SS I biology students taught nutrition in living organisms using CAI and conventional (lecture) method, the study showed that students taught with CAI base method retained better than those taught with conventional (lecture) method. This is because it improves students' retention ability and enhances mastery. Thus, there is a significant difference between the retention scores of students taught nutrition in living organisms using CAI base strategy and that of those taught using conventional (lecture) method. In this regards, Abolade and Yusuf (2005) posited that information and communication technologies are essential tools in any education system with the possibilities of being used to meet the learning needs of individual learners, support equality of education opportunities, offer high quality learning materials, increase self-efficacy and independence of learning among students, and enhance teachers' professional development.

CONCLUSION

The result of this study has provided an empirical basis on the effect of CAI on students' academic achievement and retention in biology in secondary schools in Onitsha education zone of Anambra State, indicating that CAI is innovative and capable of meeting the



contemporary teaching and learning needs of both the teacher and student. Hence, CAI is capable of improving the achievement and retention of students in science subjects including Biology. The findings from the study have revealed that the use of CAI is more beneficial than the conventional (lecture) method. In view of these findings, it is therefore concluded that CAI has significant effect on student academic achievement and retention in biology in secondary schools in Onitsha education zone of Anambra State.

RECOMMENDATIONS

In view of the afore-stated educational implication of the result of this study, the following recommendations were made:

1. CAI has been found to be effective in enhancing achievement and retention of students in biology, it is thereafter recommended for inclusion into secondary education for effective teaching and learning by curriculum planners and policy makers.
2. Government and appropriate authorities should encourage teachers' capacity development by organizing / sponsoring seminars and workshops for contemporary skill and knowledge building of teachers for effective services especially in secondary schools in Anambra State.
3. Educational stakeholder and appropriate authorities should encourage teachers to consistently utilize CAI in teaching and learning of biology for enhanced academic performance of students.

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